

ARAC Seat Harmonization Working Group

Concept Paper – Task 1 – Test Article Selection Process

1.0 Introduction

This concept paper has been developed to simplify and standardize the passenger seat test article selection process and pass/fail criteria for FAR/JAR 25.562. It presents a decision process to standardize the selection of seats based on simplified, critical case analysis. This concept paper is a further development of the concepts outlined in AC 25.562-1A, Section 6b “Selection of Test Articles”.

Examples provided in this concept paper are intended to illustrate and clarify the technical principles. They are not intended to provide firm boundaries for interpreting the material.

The selection method outlined below employs a Family of Seats defined in Section 3.0. In order for individual seat part numbers to be covered by the baseline testing defined in Section 4.0, seat components are to be consistent in their design philosophy with allowable variations driven by:

- Geometric constraints within the seat structure (for example, attachment hardware may vary between the lateral beams and the seat legs due to differences in seat track buttock lines)
- Airplane interface (for example, seat back widths may vary depending on aisle width requirements)
- Other similar requirement.

However, these differences in the seats must be justified based on procedures outlined in Section 3.0. The family of seats must be established in order to use the test article selection process described in this document. The decision process outlined below defines the tests necessary to substantiate a family of seats. Additional tests or analysis may be required to justify seat components within the family, if new and unique features are part of the seat design or to expand the seat family.

The family of seats is a philosophy in design. A group of seats can be designed using the same design concept, or as separate entities (non-family members). If the components in the seat design are carefully considered in advance, the base line testing described in this document may substantiate the majority or all of the seat part numbers for compliance to FAR/JAR 25.562. Additional tests beyond the baseline may be required to substantiate variations in seat design that are beyond the basic family principals.

Structural criticality (as required per FAR/JAR 25.307(a)) and seat family definition are two closely related, but separate topics. The objective of the requirement is to test the critical structural configuration, i.e. the seat with the critically stressed components in the primary load path. Basic seat designs that share equivalent components in the primary load path, hence the seat family concept can facilitate assessments of structural criticality. The test program defined for a family of seats may need to be expanded if there are subsequent model additions to the family, which cannot be substantiated using previous test data or appropriate engineering analysis. The need for additional tests does not change the family concept, and does not invalidate the family definition.

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The seat family is defined based on design characteristics. Structural criticality assessments determine, in part, the scope of the test program within a family, not between families. The respective discussions of seat family definition and structural criticality determination are intended to be complimentary. Determinations of structural criticality assume that the family of seats has been established, and that variations within the family will be substantiated either by tests or analysis. The decision whether to conduct tests or perform analysis is made based on the guidelines given, with the underlying assumption that such choices are made within a well-defined family. Therefore, a comparison between families to establish that one design is more structurally critical than another are beyond the scope of this paper, and are not recommended.

It is not possible to capture all possible design details or component configurations on a document such as this. The intent of this concept paper is to provide an understanding of the design and certification philosophy that has been harmonized for section FAR/JAR 25.562. Engineering judgement and interpretation applied to the design are acceptable as long as the principals of this document are the basis of that judgement.

Philosophically, the primary structural load path and other components that influence occupant injury criteria (e.g., HIC, shoulder restraint retention, etc.) are evaluated to generate the baseline certification tests. As much as practical, the other pass/fail criteria (e.g., lap belt retention, lumbar, egress, etc.) are assessed on tests that are conducted to show seat structural compliance. Additional structural tests should not be generated to evaluate parts of the seat that are not in the primary load path or influence occupant injury criteria. (For example, a test would not be conducted to evaluate the most critical load on a baggage bar if that is different than the most critical test for the seat structure.). The requirements of FAR/JAR 25.562 are satisfied by the substantiation of the structure through the baseline tests and the additional family tests outlined by this paper.

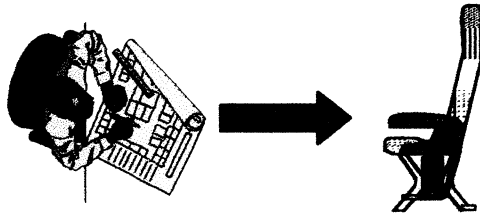
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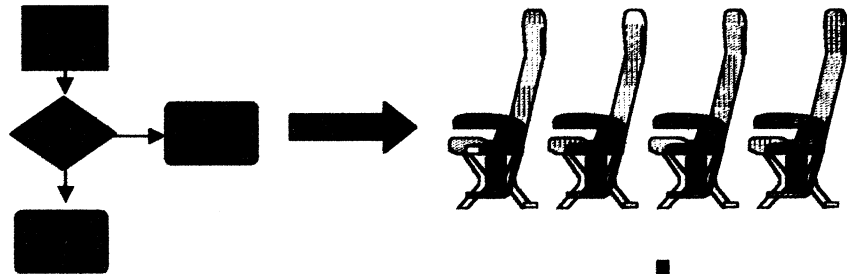
The following decision process should be applied in order to fully utilize the test article selection process outlined below:

- Step 0** Fully understand the family concept as it applies to the design philosophy.
- Step 1** Complete the seat structure design: understand, the geometric differences in seat components within the family. Define the primary structure for the family validation (which components are considered the legs, lateral beams, etc.).
- Step 2** Determine test seats based on the selection of test articles outlined in Section 4.0 below. These are considered the baseline tests.
- Step 3** Validate the test article selection by analyzing the primary load path as outlined in Section 4.0. Add additional tests if necessary to substantiate variations to seat components. Seat component variations should be addressed in one of three ways:
- 1) Establish equivalence for dynamic test purposes and no test will be required.
 - 2) Establish criticality to determine if an added test(s) would be required.
 - 3) Allow for bracketing the variation by test A new family should not automatically be the consequence of a requirement to evaluation the variation in a component.
- Iterate steps 1-3 as necessary.
- Step 4** Perform testing.
- Step 5** For changes/modifications resulting from test failures, validate the test article selection by analyzing the primary load path as outlined in Section 3.0. Some previous testing (baseline and /or additional) may have to be re-run or additional tests may have to be added.
- Step 6** Document the test results.

**Step 1 -
Complete
Design**



**Step 2 -
Determine
baseline
testing for
seat famiy**



**Step 3 - Validate
Family Concept -
add additional
tests if necessary**

